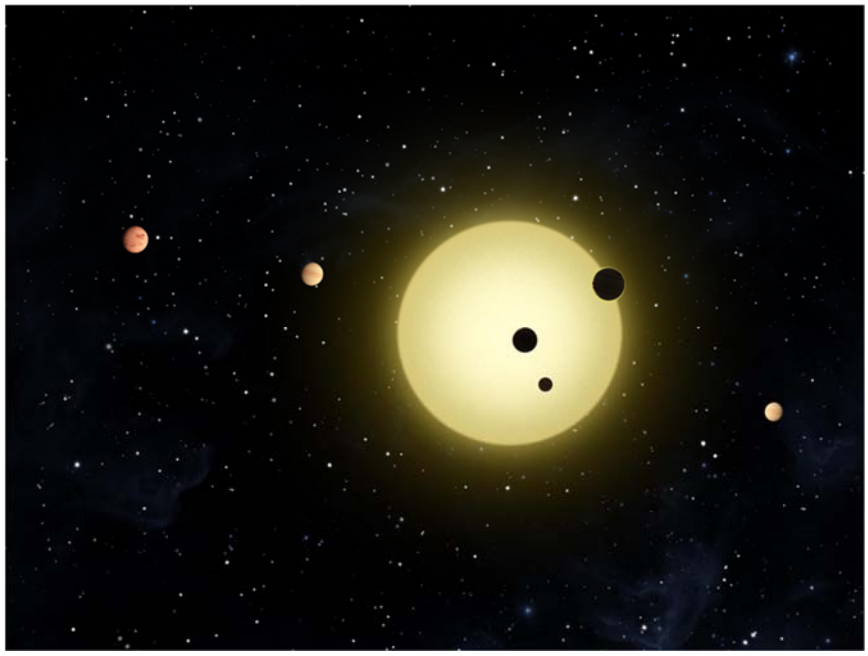
As Time Flies By



Numerous films and science-fiction novels have used time travel to send their characters to the past and the future. The technology to make time travel possible, of course, does not exist. But even if the technology needed to travel through the ages did exist, how would it actually work?

That question may not have a simple answer at the moment, but it does raise a lot of interesting points regarding what it means to "travel through time." For a regular student, one piece of this challenge that is easier to think about, is not time at all—it's space.

In 2009, a blogger and scientist who goes by the screen name "Shechner" wrote a detailed examination of time travel in the film, "Back to the Future." The hero of that story, Marty McFly, travels from the year 1985 to 1955 by driving a car that has a time travel device built into it.

During an experiment at the Twin Pines Mall in Hill Valley, California, Marty videotapes the car as it accelerates to 88 miles per hour, and disappears in a burst of smoke and flames. One minute later, the car reappears precisely where it disappeared. It has traveled exactly one minute into the future.

The interesting thing that Shechner questioned when dissecting this moment is not whether it's possible for automobile to travel one minute into the future, or 30 years into the past. His question is much more direct: if you do travel through time, how can you be sure you'll end up in the exact same place that you left?

Minutes in Motion

The science of astronomy has more to say about this riddle than any time travel theorist. That's because astronomers have spent centuries charting the stars and tracking the movements of planets across space and time. Hundreds of years of research and observation have given our civilization the very idea of time, in the form of years and days.

A single day on Earth can be broken into daytime and nighttime. The passing of day and night are caused by the rotation of the planet. Every 24 hours, the Earth makes one complete revolution on its axis. During this revolution, the parts of the Earth that face toward the Sun live in daytime. The parts of the Earth facing away from the Sun live in nighttime.

That's why it can be 1 p.m. in New York and 1 a.m. in Beijing at the very same moment. Time zones were invented to allow the people of the world to understand what time of the day it is, no matter where they might be on the planet.

Just as the Earth is rotating on its axis, it's also traveling through space. Our planet, along with all the other planets in our solar system, makes an orbit around the Sun. The amount of time it takes for the Earth to make one complete orbit is about 365 days. Our seasons and year tell us how long it takes our planet to make it all the way around the Sun, and how the Earth rotates while it's making the long, circular trip.

In this way, time is more about tracking the position of the Earth in space than about moving on some invisible track. While it's common to think about time travel as going forward and backward, it's also possible to think about time as the result of Earth's planetary motions.

Back to the Future, or Flung Into Space?

Drawing on this knowledge about space and time, consider the case of Marty McFly.

In the film "Back to the Future," Marty watches the time machine travel one minute into the future and appear in the exact same spot. Taking into account the movements of the Earth, this seems impossible. If the planet is always rotating on its axis, and at the same time always

circling the Sun, then the Twin Pines Mall parking lot wouldn't be in the same place it was just one minute earlier.

Just how far does the earth move in a single minute? According to Shechner's calculations, precisely 1,123.17 miles. This number measures the speed of Earth's orbit around the Sun as well as the speed of Earth's rotation on its axis. It may not seem like it, but every human being in the world travels over 1,000 miles per minute through space, just by being on the planet. The only thing that stops us from flying off into the atmosphere is gravity.

So, if a time traveling car cruises one minute into the future, then it could reappear a thousand miles away in space, a thousand miles deep into the Earth's crust, or a thousand miles in any other direction. It's very unlikely, however, that the car would be fast enough to catch up with the movements of the planet to end up in the exact place where it disappeared.

This puzzle isn't enough to ruin "Back to the Future," which is considered by some to be a classic of blockbuster films. And if time travel technology is invented some day, the scientists who crack the code may rely on a theory of time that doesn't depend on our understanding of space.

In the meantime, though, all of us living day-to-day on planet Earth will keep moving in circles, waiting for seasons to change and watching the stars fly past.

Name: _____ Date: _____

1. According to the passage, time travel is closely related to which of the following?

A cars
B space
C stars
D computers

2. When the author describes the earth's movements around the sun, what does he focus on?

A the way it affects how we measure time
B which forces cause the earth to move
C how Marty McFly could travel faster than the earth
D why it takes a year to rotate around the sun

3. Films and novels use time travel to send characters to the past and future.

Which evidence in the passage best supports this conclusion?

A The Twin Pines Mall is a fictional location.
B Astronomers have spent centuries charting the stars and tracking the movements of planets across space and time.
C Marty McFly travels from 1985 to 1955 in "Back to the Future."
D "Back to the Future" is considered by some to be a classic of blockbuster films.

4. If the earth never stops moving, what can you infer about time?

A It stops and starts.
B It goes both forward and backward.
C It moves faster on the Sun.
D It never stops moving.

5. What is the passage mainly about?

A a real time travel experiment at the Twin Pines Mall
B how and why humans measure time
C what Marty McFly does when he arrives in the future
D how time travel may relate to movement through space

6. Read the following sentence: "So, if a time traveling car **cruises** one minute into the future, then it could reappear a thousand miles away in space, a thousand miles deep into the Earth's crust, or a thousand miles in any other direction."

As used in the passage, what does the word "**cruises**" more nearly mean?

A travels
B stops
C explodes
D turns

7. Choose the answer that best completes the sentence below.

_____ the author is focused on traveling through time, much of the article is about traveling through space.

A Obviously
B So
C But
D Even though

8. When Marty McFly's car travels a minute into the future, how far does it move in space?

_____

_____

_____

_____

9. What does Schechner's theory of time travel conclude about a time traveling car that cruises one minute into the future?

10. Explain whether the people who made "Back to the Future" would agree with Shechner's theory of time travel. Use information from the passage to support your answer.